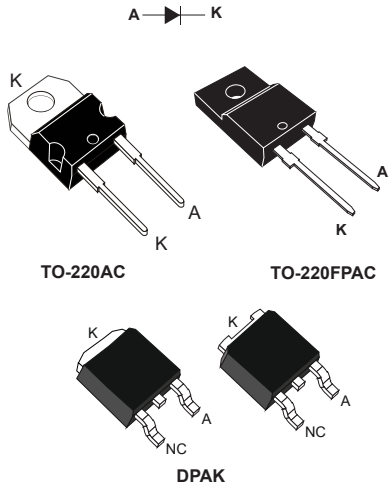
STTH512

Datasheet

1200 V, 5 A ultrafast recovery diode



Features

- Ultrafast and soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- Operating T_j from -55 °C to 175 °C
- High junction temperature
- ECOPACK2 compliant
- Insulated package: TO-220FPAC
  - Insulated voltage: 2000 V_{RMS} sine

Applications

- UPS
- Server power
- SMPS
- Motor control

Description

The high-quality design of this diode has produced a device with low leakage current, regularly reproducible characteristics, and intrinsic ruggedness. These characteristics make it ideal for heavy duty applications that demand long-term reliability.

Such demanding applications include industrial power supplies, motor control, and similar mission-critical systems that require rectification and freewheeling. These diodes also fit into auxiliary functions such as snubber, bootstrap, and demagnetization applications.

The improved performance in low leakage current, and therefore thermal runaway guard band, is an immediate competitive advantage for this device.

Product status
STTH512

Product summary	
Symbol	**Value**
$I_{F(AV)}$	5 A
V_{RRM}	1200 V
$t_{rr(typ.)}$	48 ns
$T_{j(max.)}$	175 °C
$V_{F(typ.)}$	1.25 V

1 Characteristics

Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)

Symbol	Parameter			Value	Unit
V_{RRM}	Repetitive peak reverse voltage (T_j = -40 °C to +175 °C)			1200	V
$I_{F(RMS)}$	Forward rms current	TO-220AC / TO-220FPAC		30	A
		DPAK		10	
$I_{F(AV)}$	Average forward current, δ = 0.5, square	TO-220AC / DPAK	T_L = 145 °C	5	A
		TO-220FPAC	T_L = 105 °C		
I_{FRM}	Repetitive peak forward current	t_p = 5 µs, f = 5 kHz square		60	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms sinusoidal		55	A
T_{stg}	Storage temperature range			-65 to +175	°C
T_j	Maximum operating junction temperature			+175	°C

Table 2. Thermal resistance parameter

Symbol	Parameter		Typ. value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AC / DPAK	2.5	°C/W
		TO-220FPAC	5.8	

For more information, please refer to the following application note:

- AN5088: Rectifiers thermal management, handling and mounting recommendations

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
I_R(1)	Reverse leakage current	T_j = 25 °C	$V_R = V_{RRM}$	-		5	µA
		T_j = 125 °C		-	3	30	
V_F(2)	Forward voltage drop	T_j = 25 °C	I_F = 5 A	-		2.2	V
		T_j = 125 °C		-	1.30	2.00	
		T_j = 150 °C		-	1.25	1.9	

1. *Pulse test: t_p = 5 ms, δ < 2%*
2. *Pulse test: t_p = 380 µs, δ < 2%*

To evaluate the conduction losses, use the following equation:

$P = 1.5 \times I_{F(AV)} + 0.08 \times I_F{}^2{}_{(RMS)}$

For more information, please refer to the following application notes related to the power losses :

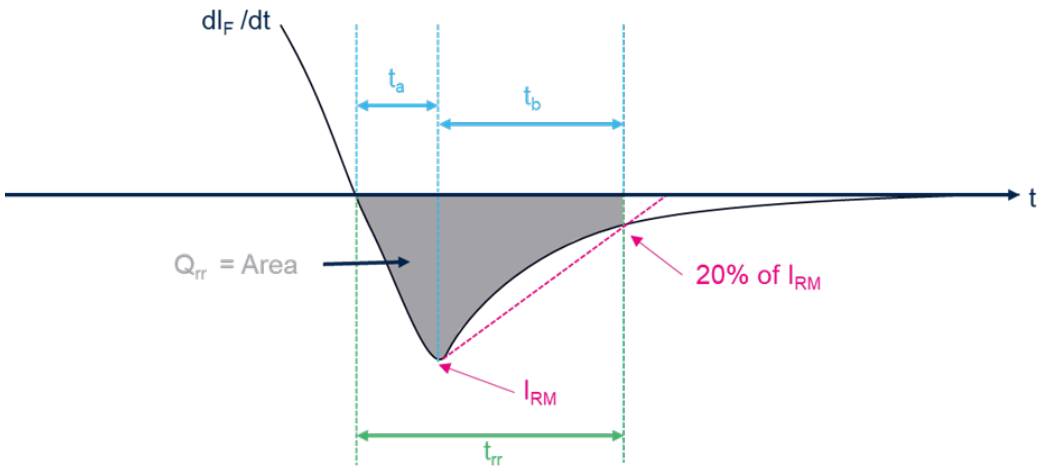
- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

Table 4. Dynamic electrical characteristics

Symbol	Parameters	Test conditions		Min.	Typ.	Max.	Unit
t_{rr} (1)	Reverse recovery time	T_j = 25 °C	I_F = 1 A dI_F/dt = -50 A/µs V_R = 30 V	-		95	ns
			I_F = 1 A dI_F/dt = -100 A/µs V_R = 30 V	-	48	70	
I_{RM} (1)	Reverse recovery current	T_j = 125 °C	I_F = 5 A dI_F/dt = -200 A/µs V_R = 600 V	-	11	16	A
S_{factor}	Softness factor		I_F = 5 A dI_F/dt = -200 A/µs V_R = 600 V		2		
Q_{rr} (1)	Reverse recovery charge		I_F = 5 A dI_F/dt = -200 A/µs V_R = 600 V	-	960		nC

1. *Measurements taken at 20% of I_{RM}, $S = t_b/t_a$.*

Figure 1. Reverse recovery time, current and charges measurement across D.U.T (device under test)



1.1 Characteristics (curves)

Figure 2. Conduction losses versus average current

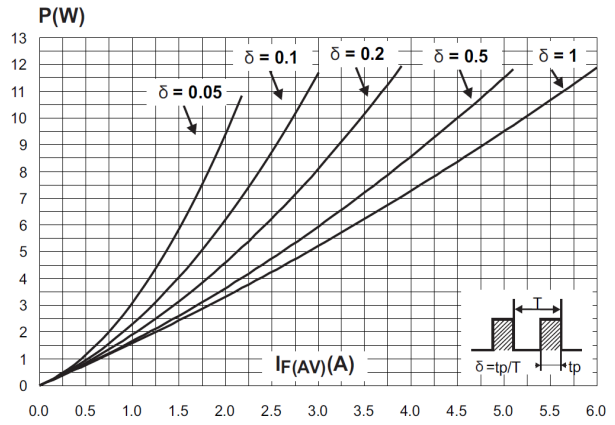


Figure 3. Forward voltage drop versus forward current

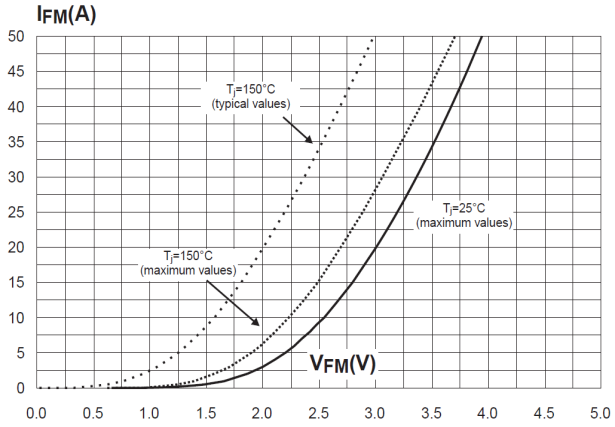


Figure 4. Relative variation of thermal impedance junction to case versus pulse duration

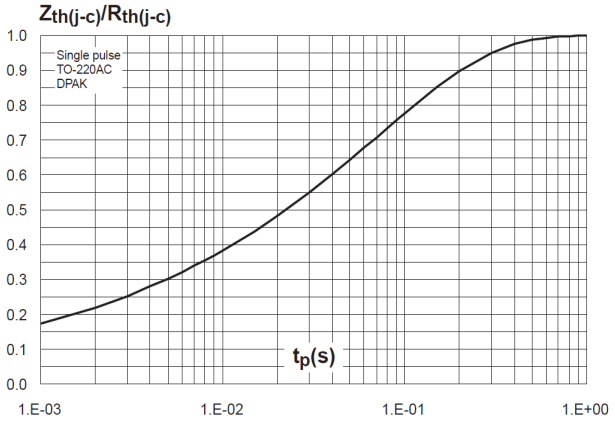


Figure 5. Relative variation of thermal impedance junction to case versus pulse duration

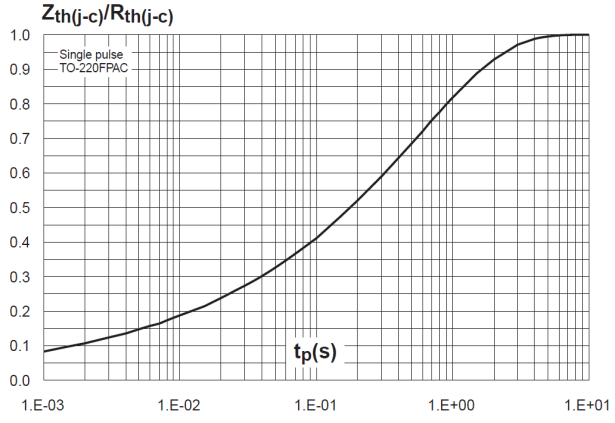


Figure 6. Peak reverse recovery current versus dI_F/dt (typical values)

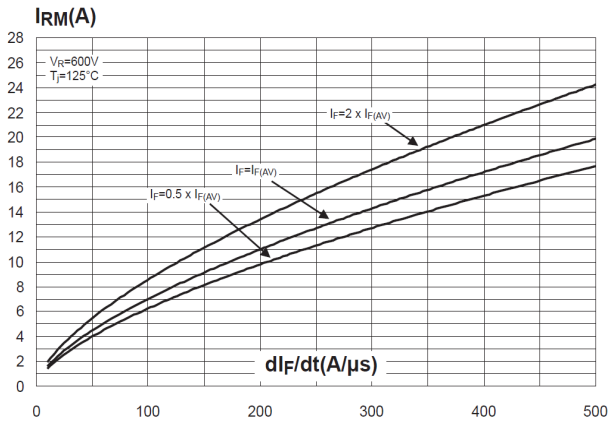


Figure 7. Reverse recovery time versus dI_F/dt (typical values)

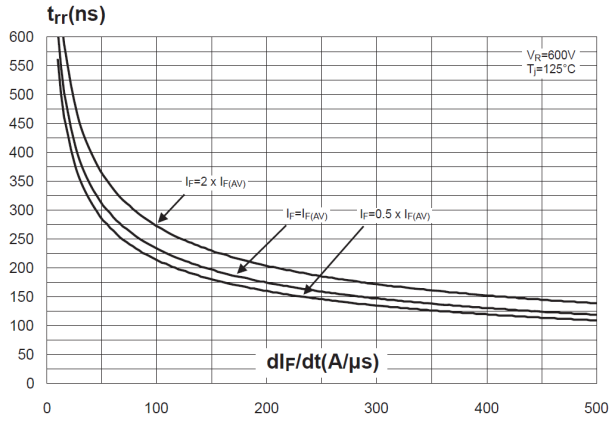


Figure 8. Reverse recovery charges versus dI_F/dt (typical values)

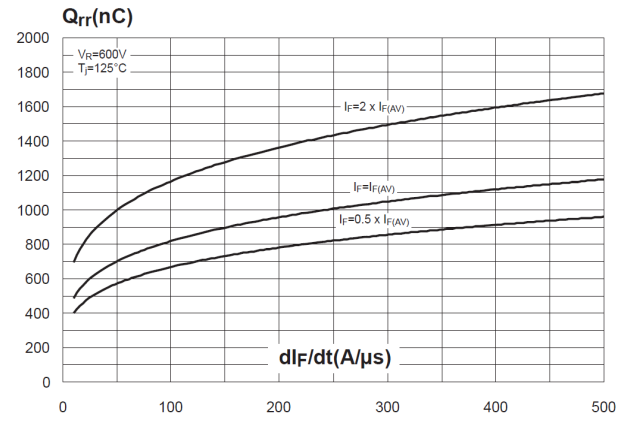


Figure 9. Softness factor versus dI_F/dt (typical values)

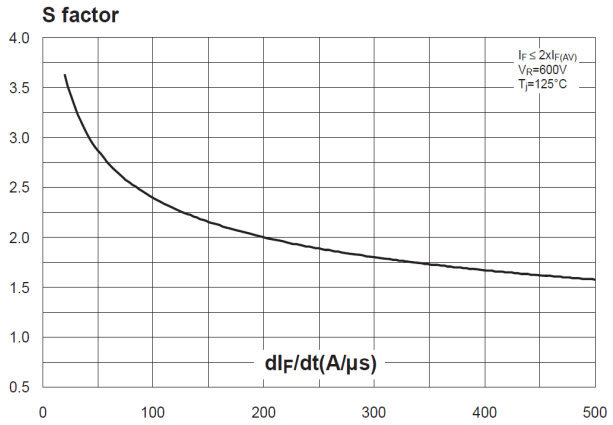


Figure 10. Relative variations of dynamic parameters versus junction temperature

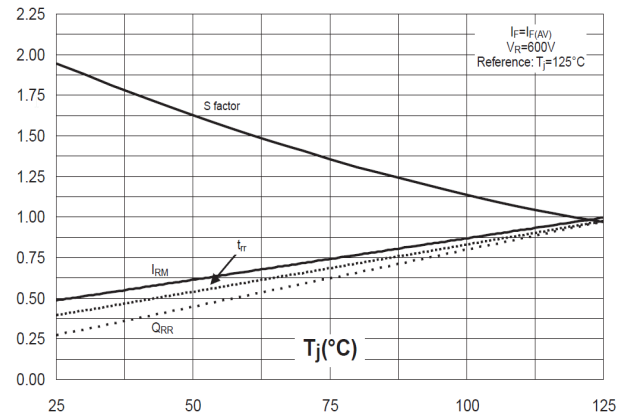


Figure 11. Transient peak forward voltage versus dI_F/dt (typical values)

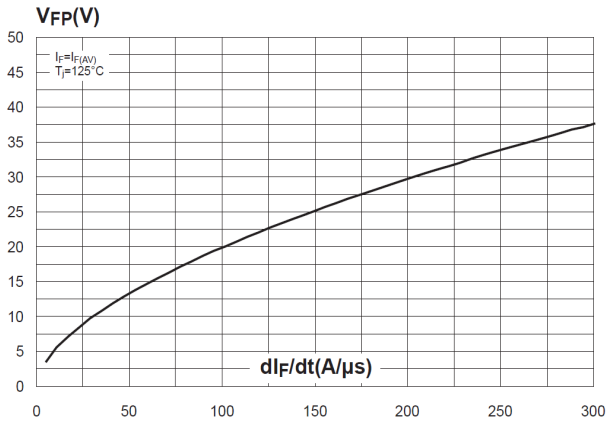


Figure 12. Forward recovery time versus dI_F/dt (typical values)

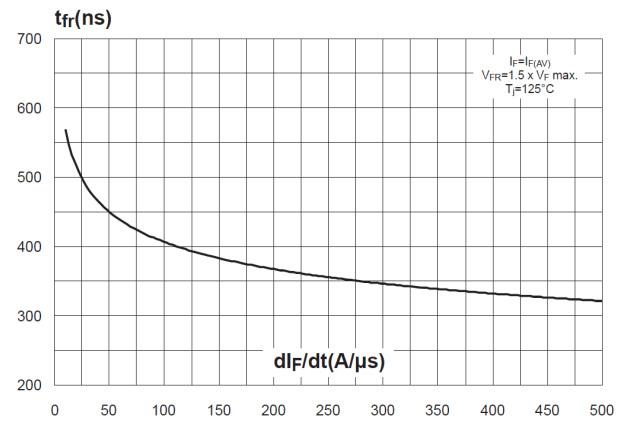


Figure 13. Junction capacitance versus reverse voltage applied (typical values)

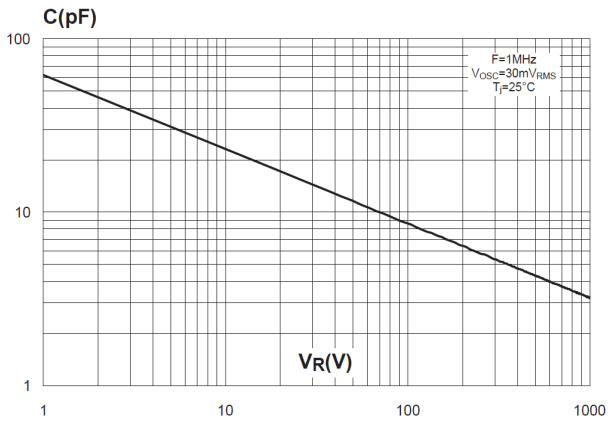
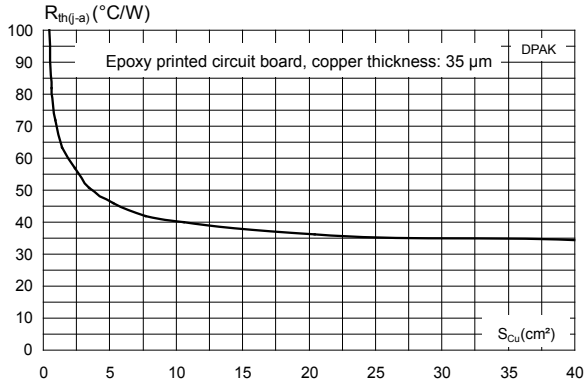


Figure 14. Thermal resistance junction to ambient versus copper surface under tab (typical values)



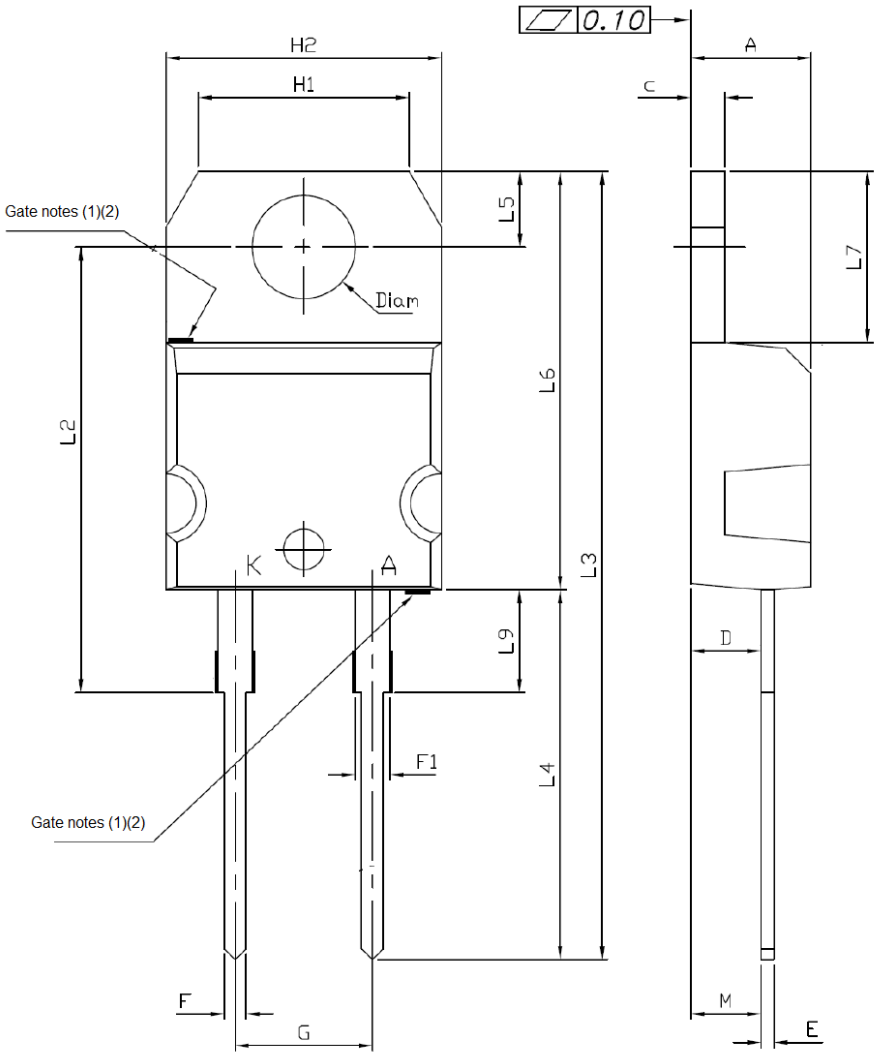
2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 TO-220AC package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 15. TO-220AC package outline



(1) : Max resin gate protusion 0.5 mm

(2) : Resin gate position is accepted in each of the two positions shown on the drawings or their symmetrical

Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

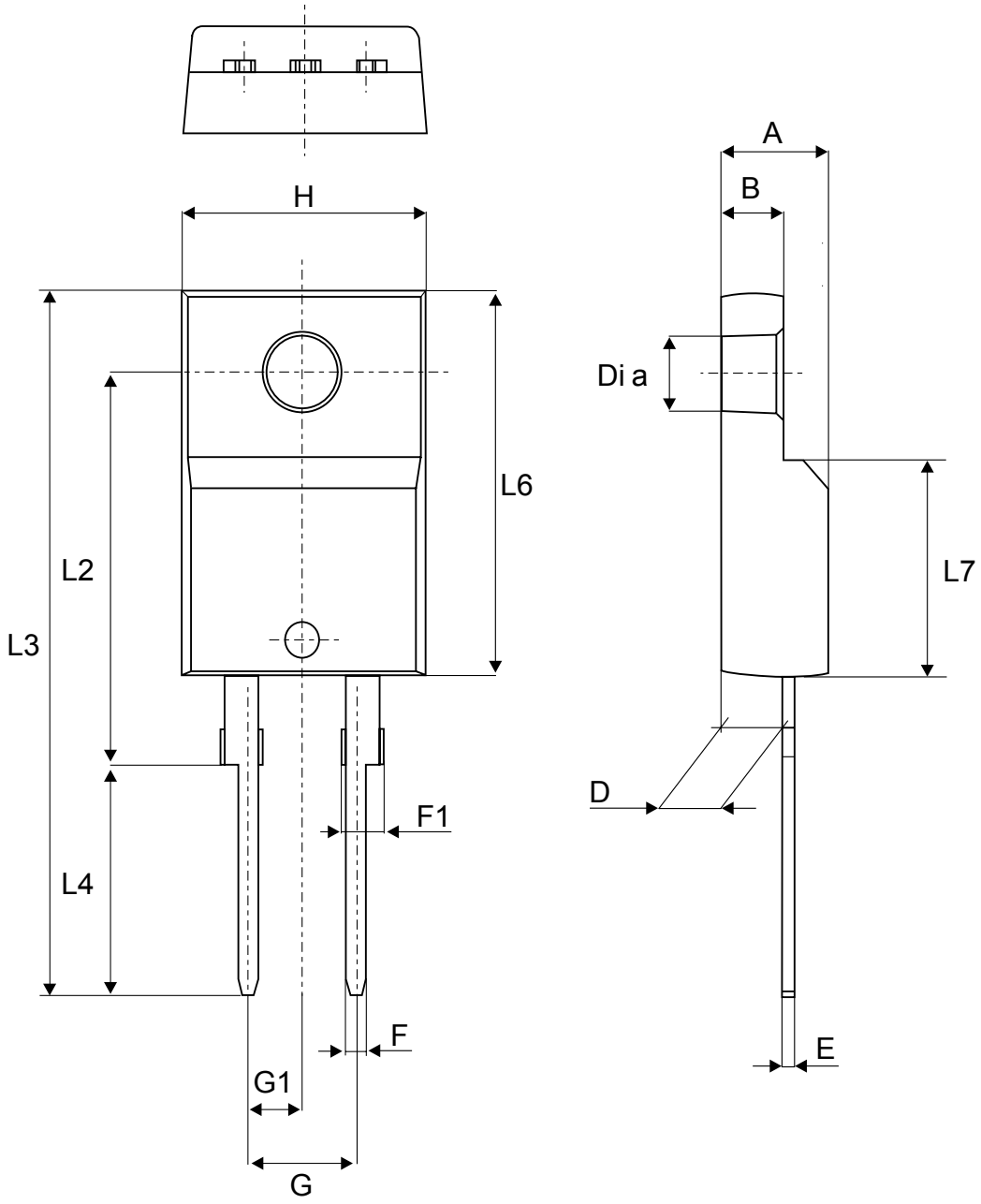
Table 5. **TO-220AC package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.066
G	4.95		5.15	0.194		0.202
H2	10.00		10.40	0.393		0.409
L2		16.40			0.645	
L4	13.00		14.00	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.20		6.60	0.244		0.259
L9	3.50		3.93	0.137		0.154
M		2.60			0.102	
Diam	3.75		3.85	0.147		0.151
Slug flatness		0.03	0.10		0.001	0.004

2.2 TO-220FPAC package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 16. TO-220FPAC package outline



Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

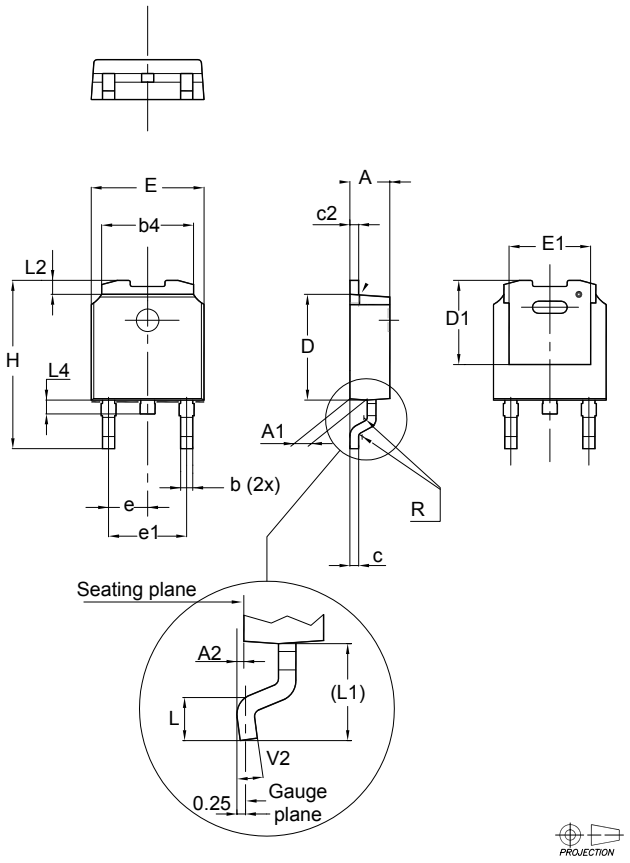
Table 6. **TO-220FPAC package mechanical data**

Ref.	Dimensions			
	Millimeters		Inches (for reference only)	
	Min.	Max.	Min.	Max.
A	4.40	4.60	0.173	0.181
B	2.50	2.70	0.098	0.106
D	2.50	2.75	0.098	0.108
E	0.45	0.70	0.018	0.027
F	0.75	1	0.030	0.039
F1	1.15	1.70	0.045	0.067
G	4.95	5.20	0.195	0.205
G1	2.4	2.70	0.094	0.106
H	10	10.40	0.393	0.409
L2	16 typ.		0.63 typ.	
L3	28.6	30.60	1.126	1.205
L4	9.8	10.60	0.386	0.417
L6	15.9	16.40	0.626	0.646
L7	9.00	9.30	0.354	0.366
Diam	3.00	3.20	0.118	0.126

2.3 DPAK package information

- Epoxy meets UL94, V0

Figure 17. DPAK package outline



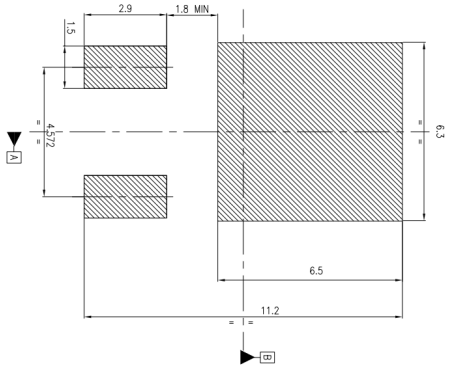
Note: This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 7. **DPAK mechanical data**

Dim.	Dimensions					
	Millimeters			Inches[1]		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
b	0.64		0.90	0.025		0.035
b4	5.20		5.40	0.205		0.213
c	0.45		0.60	0.018		0.024
c2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
D1	4.95	5.10	5.25	0.195	0.201	0.207
E	6.40		6.60	0.252		0.260
E1	4.60	4.70	4.80	0.181	0.185	0.189
e	2.159	2.286	2.413	0.085	0.090	0.095
e1	4.445	4.572	4.699	0.175	0.180	0.185
H	9.35		10.10	0.368		0.398
L	1.00		1.50	0.039		0.059
(L1)	2.60	2.80	3.00	0.102	0.110	0.118
L2	0.65	0.80	0.95	0.026	0.031	0.037
L4	0.60		1.00	0.024		0.039
R		0.20			0.008	
V2	0°		8°	0°		8°

1. *Inches dimensions given for reference only*

Figure 18. **DPAK recommended footprint (dimensions are in mm)**



Note: For package and tape orientation, reel and inner box dimensions and tape outline please check TN1173

3 Ordering information

Table 8. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH512D	STTH512D	TO-220AC	1.86 mg	50	Tube
STTH512FP	STTH512FP	TO-220FPAC	1.90 mg	50	Tube
STTH512B-TR	STTH512B	DPAK	0.32 mg	2500	Tape and reel

Revision history

Table 9. **Document revision history**

Date	Revision	Changes
02-Mar-2006	1	Initial release.
26-Nov-2014	2	Updated DPAK package information and reformatted to current standard.
24-Feb-2016	3	Updated DPAK package information and reformatted to current standard.
11-Dec-2023	4	Updates t_{fr} and Figure 1.